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LABOUR PARTICIPATION AND LABOUR MARKET DYNAMICS IN AN EMPIRICAL FLOW MODEL WITH HETEROGENEOUS UNEMPLOYMENT

by F.A.G. den Butter*

1. INTRODUCTION

Today, low labour participation and a high demand for social security is a major economic problem in a number of West-European countries, and especially in The Netherlands. The dramatic rise of the so called 'inactivity ratio' i.e. the ratio between the number of those receiving government benefits and of active workers in the past twenty years is illustrative. In 1970 this ratio was less than 0.5 in The Netherlands so that more than two workers earned the benefit of each person receiving such benefit. However, in the 1990's the ratio has risen to over 0.8 so that each worker has to earn almost a full benefit of another person. Belgium, Germany and France have even higher inactivity ratio's, but this can partly be ascribed to a more unfavourable age composition of the population in these countries (see Ministry of Social Affairs and Employment, 1995, p. 11).

In The Netherlands, most policy proposals in order to curb this development (see e.g. WRR, 1990) aim at enhancing labour participation by a reduction of the eligibility for social security, or by stimulating labour supply in an other way. However, it is questionable whether or not implementation of these proposals will augment employment indeed. According to the traditional disequilibrium modelling of the labour market such labour supply shocks will not enhance employment very much in the actual situation of a supply surplus. In that case, an increase in labour supply results in an increase in unemployment of just the same size. However, an equilibrium unemployment model of the labour market, which focusses on labour market flows and on the matching process, provides arguments that a supply shock may enhance demand indeed.

This paper gives a quantitative analysis of the employment effects of labour supply and demand shocks, by using a dynamic macro model of labour market flows and stocks in The Netherlands. At the core of the model is a matching function of unemployed and vacancies, which determines the flow out of unemployment and describes the search process of employers and employees. According to the matching function, a labour supply shock, implemented as an initial increase in unemployment, may, given the number of vacancies (labour demand), 'produce' more matches and hence lead to more employment. Although this mechanism has been extensively described in the

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theoretical models of the flow approach (see Pissarides, 1990, Mortensen and Pissarides, 1994) and although a number of empirical studies have estimated specifications of the matching function (see Blanchard and Diamond, 1989, Van Ours, 1991), to our knowledge no much work has been done to determine the magnitude of these effects in a consistent manner in real world situations.

This study purports to do so from the Dutch perspective. In the present situation in The Netherlands (like in most industrialized countries) the number of unemployed is much larger than the number of (registered) vacancies. It implies a considerable asymmetry in the effects of labour demand and supply shocks in the matching function: an increase in the number of vacancies will lead to a much larger outflow from unemployment than the same increase in the number of unemployed. That is true in the case of homogeneous unemployment, but unemployment may be heterogeneous: long-term unemployed may have a lower escape probability from unemployment than short-term unemployed. Then they have a smaller weight in the matching function. Therefore, when the share of long-term unemployment is large, the asymmetry in the matching function will be less pronounced and a labour supply shock will be more effective in enhancing employment. However, in a consistent model of labour market flows, not only the matching function matters, but equations describing the changes in stocks (equations of motion) should be added to the specification of the matching function in order to arrive at the proper description of the propagation dynamics of labour supply and demand shocks. Hence, the aim of the paper is to provide a sensitivity analysis of various specifications of the matching function in a consistent structural model of labour market flows.

In order to investigate how the specification of the matching function and the assumptions on the heterogeneity of unemployment affect the effects of autonomous labour supply and demand shocks, the rest of the model is kept as simple as possible. The model explicitly describes the flows of unemployed through various duration classes, which determine the escape probabilities from unemployment. Therefore, in case of duration dependent escape probabilities from unemployment, the model cannot be solved analytically and numerical simulations are needed to show the effects of labour participation policy on employment.

The next section presents the model of labour market flows and indicates how the model is calibrated with respect to time series data on these flows for The Netherlands. Section 3 discusses some analytical results in the case of homogeneous unemployment, i.e. when there is no duration dependence. Section 4 gives the results of impulse simulations using the model, which show how shocks advance through the various duration classes. A sensitivity analysis reveals to what extent, according to alternative model specifications, a labour supply shock indeed enhances employment. Finally, section 5 concludes.

2. THE MODEL

Our model distinguishes three labour market positions for the working age population: the *employed*, the *unemployed* and the *(voluntary) non-participants* (= outside the labour force). In addition to the relevant flows of persons between these stocks (see also Marston, 1976), the model also describes the stock of *vacancies* and the consequent flows of jobs. Obviously these flows of jobs are linked to the flows of persons: the model explicitly takes account of these relationships. The disaggregation of the various duration classes of unemployment enables us to consider short term unemployed (U_S) and long term unemployed (U_L) separately. The version of the model used in the simulation experiments is specified on a monthly basis, which proves to approximate the continuous time character of the theoretical model sufficiently. In case of longer time intervals, e.g. an annual model, some model versions yield a net outflow of vacancies which is larger than the stock of vacancies, so that in the next period the stock of vacancies becomes negative. The model uses a consistent data set, constructed by Broersma and Den Butter (1994), on all different flows of persons and jobs between the stocks at the macro level.

As mentioned before, the matching function (or hiring function) of unemployed and vacancies is the main behaviourial equation of the model. This equation describes the outflow from unemployment of those unemployed who find a new job for which a vacancy exists. In a general specification this flow of new jobs (F_{uev}) depends on the stock of unemployed (U) and the stock of vacancies (V).

$$F_{uev} = f(V,U)$$

Yet, in this matching function not all unemployed necessarily have the same weight: the escape probability from unemployment may become lower (in the case of negative duration dependence) when the spell of unemployment lasts longer. Since our model explicitly considers the flows of unemployed through various duration classes (U_k, k=1,..,∞), this duration dependence of the escape probability from unemployment is described in a consistent manner at the macro level. Following empirical evidence on the matching function we use a constant returns Cobb-Douglas specification:

$$F_{uev} = c\, V^{1-\alpha}\, (U')^{\alpha}$$

with α the weight given to the composite unemployment variable in the matching process, and with c a constant term representing the efficiency of the matching process, and where

$$U' = \sum_{k=1}^{\infty} U_k\, g(\theta, k); \qquad 0 < \theta \leq 1$$

Here the weight g(θ, k) of each duration class depends on the duration dependence parameter θ and on the length of a spell of unemployment k. In case of negative duration dependence this weight falls with the length of the unemployment spell k. The number of unemployed in the first duration class is equal to the inflow into unemployment (UI)

$$U_{1,t} = UI$$

and for the following duration classes holds

$$U_{k,t} = (1-\pi_{k-1,t})\, U_{k-1,t-1}$$

where $\pi_{1,t} = UO / U'$

and $\pi_{k,t} = \pi_{1,t}\, g(\theta, k)$

are the escape probabilities from duration classes 1 and k respectively, with UO the outflow from unemployment. In case the parameter θ is equal to unity we have no duration dependence and all unemployed obtain the same weight in the matching function. A θ between 1 and 0 assumes that the probability of unemployed finding a job reduces when unemployment duration increases. Such negative dependence on the macro level may either be the result of duration dependence on the micro level or may be caused by heterogeneity on the micro level. Both types of duration dependence require different policy measures. Van Ours (1992) and Van den Berg and Van Ours (1994) attempt to separate both sources of duration dependence empirically at the macro level.

In order to keep our model simple, in most simulation experiments we only distinguish between short term unemployment (U_S; < 1 year) and long term unemployment (U_L; > 1 year). In this special case the matching function is specified as

(1) $$F_{uev} = c\, V^{1-\alpha}(U_s + \theta U_L)^{\alpha}$$

with

(1b) $$\pi_S = UO / (U_s + \theta U_L)$$

(1c) $$\pi_L = \theta \pi_S$$

where $U_{1,t} = UI$[1]

$$U_{k,t} = (1-\pi_S)\, U_{k-1,t-1} \quad \text{for } k = 2,3,\ldots,12$$

$$U_S = U_1 + U_2 + \ldots + U_{11} + U_{12}$$

$$U_L = U - U_S$$

(and $U_L = (1-\pi_L)\, U_{L,t-1} + (1-\pi_S)\, U_{12,t-1}$ [2]).

In order to account for feedback mechanisms we need to close the models using simple definition equations. The second equation says that the outflow of vacancies (VO_u) associated with the

[1] As our simulation model is specified with discrete time intervals, we have also experimented with a model version which accounts for the outflow from unemployment within the first duration class (month) in the following way:

$$U_{1,t} = (1-0.5\pi_S)\, UI$$

This change in specification does not, however, alter the simulation results very much.

[2] As the model is based on discrete time intervals, this identity only approximately holds in the simulation experiments.

succesful matches described by the matching function is equal to the flow to employment of those who find a job by filling a vacancy:

$$(2) \qquad VO_u = F_{uev}$$

Next we have the equations of motion which set the stocks of the model equal to the respective stocks in the previous period plus the inflows (VI, UI, EI) minus the outflows (VO, UO, EO):

$$(3) \qquad V = V_{-1} + VI - VO$$
$$= V_{-1} + VI - VO_u - VO_{ex}$$

$$(4) \qquad U = U_{-1} + UI - UO$$
$$= U_{-1} + F_{nu} + UI_{ex} - F_{uev} - UO_{ex}$$

$$(5) \qquad E = E_{-1} + EI - EO$$
$$= E_{-1} + F_{uev} + EI_{ex} - EO$$

Here VI, VO_{ex}, F_{nu}, UI_{ex}, UO_{ex}, EI_{ex}, and EO are exogenous flows. The five equations above constitute the flow model used in the following analytical analysis and in the simulation experiments. In these calculations impulses to the autonomous flows VI and F_{nu} represent labour demand and labour supply shocks.

In this model the matching function is a structural equation which describes search behaviour. Search theory provides the micro-economic foundation for the specification of the matching function, but this modelling is still rather mechanical (see also Blanchard and Diamond, 1992). Wage formation as market clearing mechanism and the decision making process of labour market participants remain implicit in the model. However, this paper purports to give a quantitative assessment of the consequences of the search process, evoked by labour market flows in a consistent manner at the macro level. For that purpose there is no need for an explicit modelling of the underlying decision making process. The relation between this process and the specification of the matching function of this paper has extensively been described in the literature.

The central projections used in the simulation experiments are constructed as dynamic equilibria based on average monthly values in the last year of observation from the consistent data set by Broersma and Den Butter (1994), and are calculated given the equilibrium values of stock quantities. The list of symbols shows the annual amounts for the respective flows (in numbers of persons/jobs x 1000) in parentheses. Rather than estimating this matching function we calibrate our model and base its empirical specification on estimates by Van Ours (1991) for The Netherlands (see also Blanchard and Diamond, 1989). In the basic version of our model we set $\alpha = 0.5$ and $\theta = 0.5$, but these parameter values will be subject of a sensitivity analysis. The constant term c of the matching function is determined by the dynamic equilibrium, given the other parameter values of the matching function, and given the data on F_{uev}. Hence, generally the value of c differs in each alternative central projection. The basic projection assumes 400.000 unemployed, 50.000 vacancies and a total employment of 6 million, which mimics the present situation in the Netherlands. According to this projection the share of long-term unemployed in total unemployment amounts to about 40%. This is in accordance with the actual percentage in the early 1990's, which may indicate that the labour market situation in that period can be described adequately by the dynamic equilibrium and the escape probabilities from unemployment of the basic projection of our model.

The main characteristic of the basic specification and of the alternatives used in the sensitivity analysis are listed in table 1. The alternative projection 1 represents the situation with an equal number of vacancies and unemployed [3]. This projection yields a dynamic unemployment equilibrium in which, given the specification of the matching function, the effects of supply and demands shocks on employment are symmetrical. Alternative projection 2 illustrates a situation of low labour market dynamics: in the central projection all data on labour market flows are set to 1/3 of their value in the basic projection. Now, in equilibrium, the share of long-term unemployment in total unemployment is over 70%. Here U' is smaller than U' of the basic projection so that, according to the matching function, a labour supply shock is expected to have a larger effect on employment in this situation of low labour market dynamics than in the basic projection. On the same ground we expect the effect of a supply shock to be even larger in alternative projection 3 which has the same low labour market dynamics as alternative 2 but also a lower escape probability for long-term unemployed: $\theta = 0.2$ instead of 0.5. Additionaly, in alternative projection 4 unemployment obtaines a high weight in the matching function (0.8 instead of 0.5), which will again enhance the relative effect of a labour supply shock as compared to that of a labour demand shock.

Table 1.Numerical values for baseline models
(E = 6,000,000)

Specification	U (x 1000)	V (x 1000)	α	θ[1]	U_L/U (in %)	Flows
Basic	400	50	0.5	0.5	39.9	according to data set
Alternative 1	100	100	0.5	0.5	1.1	according to data set
Alternative 2	400	50	0.5	0.5	72.6	1/3 of flows data set
Alternative 3	400	50	0.5	0.2	76.4	1/3 of flows data set
Alternative 4	400	50	0.8	0.2	76.4	1/3 of flows data set
Alternative 5	400	50	0.6[2]	0.5	39.9	according to data set
Alternative 6	400	50	0.5	0.75[3]	40.2	according to data set
Alternative 7	400	50	0.5	0.25[3]	62.4	according to data set

[1]θ = 1.0 in the calculations of section 3.
[2]Increasing returns to scale in the matching function with $F_{uev} = c\, V^{\beta}\, U'^{\alpha}$, where $\alpha = 0.6$ and $\beta = 0.6$.
[3]Continuous weight function $g(\theta,k) = k^{\theta-1}$

[3] This alternative version of the model needs a monthly specification (or a specification with smaller intervals) because in a quarterly specification the escape probability of the short term unemployed ($\pi_S = UO / (U_S + \theta U_L)$) exceeds unity.

Although the hypothesis of constant returns to scale in the matching function is maintained in most empirical studies, the theory provides arguments for a matching function with increasing returns to scale (see Burdett *et al.*, 1994). For that reason alternative projection 5 assumes increasing returns to scale in the matching function. In this alternative the specification of the rest of the model is the same as that of the basic specification. The last two alternatives show what happens to labour market dynamics in case of a smoothly decreasing escape probility from unemployment. In alternative projection 6 the weight function $g(\theta,k)$ is set equal to $k^{\theta-1}$, with $\theta = 0.75$, so that the escape probabilities are, on average, the same as in the basic projection. Alternative projection 7 has $\theta = 0.25$ and assumes a much larger negative duration dependence[4].

3. NUMERICAL ANALYSIS OF THE EFFECTS OF SUPPLY SHOCKS

Before we come to our simulation experiments, we give a numerical analysis of the effects of supply shocks and a breakdown in various components using an analytical solution of the model. As such solution is only feasible in case of no duration dependence, we have taken $\theta = 1$ in this section. The following formula shows that the effect of a labour supply shock on employment ($\partial E/\partial F_{nu}$), which is in this case equal to the outflow from unemployment by filling a vacancy ($\partial F_{uev}/\partial F_{nu}$), can be disaggregated into two components: the first component is the effect according to the matching function ($\partial F_{uev}/\partial U$) and the second effect ($\partial U/\partial F_{nu}$) measures the change of unemployment induced by the supply shock.

Fout!

Fout!

However, these are only short term effects because U_{-1}, V_{-1} and E_{-1} are kept exogenous. The long-term effects can only be calculated using model simulations. Hence, there is a third component which represents the difference between the long-term and the short-term effect. We note that the latter two components of the effect of a supply shock are usually neglected in studies of the matching function or in UV-analysis.

[4] In this case all unemployment duration classes are to be considered separately as they have different escape probabilities. In our numerical simulations we have, in alternatives 6 and 7, truncated the individual unemployment classes after the unemployment class of 301 months. Experiments with later truncations showed that this truncation does not affect the results very much.

Table 2 gives these three components of the effects of labour supply shocks on employment according to the alternative model specifications. The table shows that the supply effect is much larger when we only reckon with the matching function than when we consider the short-term effect according to the entire model. The short-term effects appear to be much smaller in the case of low labour market dynamics (alternatives 2 and 3: they do not differ here as in the model versions of this section θ = 1.0) than in the basic specification of the model. This is because the flow of unemployed who find a job by filling a vacancy and hence the efficiency of matching in the alternatives with low labour market dynamics is 1/3 of that in the basic model specification. However, according to the model simulations, the long-run effects of a supply shock are almost equal in case of normal and of low labour market dynamics. Thus, the results of table 2 show that calculating the effects of labour supply shocks on employment by means of a matching function can be misleading, when the feedback mechanisms at the macro level are overlooked. When the pace of labour market dynamics resembles that of the basic specification the supply shock effects are overestimated by the matching function. On the other hand, they are underestimated in the case of low labour market dynamics.

Table 2Effects of labour supply shocks on employment
(in % of the size of the shock which is implemented as an autonomous change of F_{uu})

According to	Model specification Basic	Alt. 1	Alt. 2/3	Alt. 4	Alt. 5
Analytical computation, short term					
matching function	25.0	100.0	8.3	13.3	30.0
entire model	7.7	33.3	4.8	9.5	8.1
Dynamic simulation					
positive shock; effect after					
1 yr.	7.2	29.5	4.5	9.2	7.5
3 yrs.	9.9	42.3	8.4	19.9	9.9
6 yrs.	10.1	43.8	9.8	26.2	10.1
10 yrs.	10.1	43.8	10.1	28.3	10.1
negative shock; effect after					
1 yr.	-8.3	-37.9	-5.0	-9.9	-8.8
3 yrs.	-11.9	-54.2	-9.8	-22.5	-12.0
6 yrs.	-12.3	-56.1	-11.8	-31.6	-12.3
10 yrs.	-12.3	-56.2	-12.2	-36.0	-12.3

4. EFFECTS OF SUPPLY AND DEMAND SHOCKS IN SIMULATION EXPERIMENTS

This section presents simulation results of labour supply and demand shocks in case of heterogeneous unemployment, where, in most versions of the model, $\theta = 0.5$ so that the escape probability from unemployment is two times as large for short-term unemployed as for long-term unemployed ($\theta = 0.2$ in alternatives 3 and 4). The simulations illustrate the time profile of the impulse-responses to the shock, which results from the explicit modelling of the propagation of the shock through the various duration classes. Finally, a new equilibrium is reached. It is assumed that the additional labour supply enters unemployment through the first duration class and has the escape probability of short-term unemployed. In order to avoid negative stocks, the simulated (temporary) impulse of 50,000 is distributed over the twelve months of the first year of the simulation period, whereas impulse effects are measured at the end of the year. The size of the impulse in supply is rather large as compared to the historical shocks, which have, according to the annual time series constructed by Broersma and Den Butter (1994) a standard deviation of 15,000, but an increase in labour supply of 50,000 seems a feasible outcome of policy measures which enhance labour participation in The Netherlands. Moreover the main purpose of these simulations is to illustrate the relative effects of labour supply and demand shocks.

Table 3.The effects of an autonomous change of vacancies (demand shock), and of unemployed (supply shock), basic specification

	Increase of vacancies after					Increase of unemployed after			
Effects on	1 yr.	2 yrs.	3 yrs.	6 yrs.		1 yr.	2 yrs.	3 yrs.	6 yrs.
employment	25.6	41.6	44.5	45.1		3.8	4.5	4.1	4.0
vacancies 24.4	8.4	5.5	4.9		-3.8	-4.5	-4.1	-4.0	
unemployment (x 1,000)	-25.6	-41.6	-44.5	-45.1		46.2	45.5	45.9	46.0
% unempl.> 12 months (% points)	-0.1	-3.0	-4.1	-4.4		-2.9	3.6	3.9	3.9
	Decrease of vacancies after					Decrease of unemployed after			
Effects on	1 yr.	2 yrs.	3 yrs.	6 yrs.		1 yr.	2 yrs.	3 yrs.	6 yrs.
employment	-29.1	-43.8	-45.7	-46.0		-4.3	-5.3	-4.9	-4.9
vacancies -20.9	-6.2	-4.3	-4.0		4.3	5.3	4.9	4.9	
unemployment (x 1,000)	29.1	43.8	45.7	46.0		-45.7	-44.7	-45.1	-45.1
% unempl.> 12 months (% points)	0.2	3.1	3.8	3.9		3.4	-4.0	-4.4	-4.4

Explanatory note: shocks are represented by an autonomous change of 4,167 in each month of the first year of the simulation period.

Table 3 gives the results of autonomous labour demand and supply shocks according to the basic version of the model. The table shows that, according to this version of the model, a positive demand shock, which brings about an initial increase in the number of vacancies, enhances employment very much. In the long run (i.e. after 6 years) almost all additional vacancies are filled up and unemployment has decreased accordingly. Long-term unemployment has come down with over 4 %-points. Comparison of the results of the two blocks at the left hand side of table 1 demonstrates that there is substantial symmetry between the effects of positive and negative demand shocks.

A positive labour supply shock gives a different picture. This shock has, according to the model, no substantial effect on employment: in the long run the increase in employment is less than 10% of the additional labour supply. Most new entrants on the labour market remain unemployed so that the 'inactivity ratio' does not really drop by such supply policy. The share of the long-term unemployed decreases in the first year of the shock because at that time the unemployed new entrants are still short term unemployed, but in the long run this share exceeds that of the baseline because most new entrants remain unemployed or take jobs of others who become long term unemployed. Similar to the demand shocks, the positive and negative supply shocks appear to be almost symmetrical.

Table 4.The effects of an autonomous increase of vacancies (demand shock), and of unemployed (supply shock), alternative specification 1 (equal number of vacancies and unemployed)

	Increase of vacancies after				Increase of unemployed after			
Effects on	1 yr.	2 yrs.	3 yrs.	6 yrs.	1 yr.	2 yrs.	3 yrs.	6 yrs.
employment	12.7	20.4	21.8	22.1	13.9	20.3	21.0	21.2
vacancies	37.3	29.6	28.2	27.9	-13.9	-20.3	-21.0	-21.2
unemployment (x 1,000)	-12.7	-20.4	-21.8	-22.1	36.1	29.7	29.0	28.8
% unempl.> 12 months (% points)	2.6	0.2	-0.7	-0.9	-3.1	3.2	3.0	2.9

Explanatory note: shocks are represented by an autonomous increase of 4,167 in each quarter of the first year of the simulation period.

Table 4 gives the results of positive supply and demand shocks according to alternative version 1 of the model, which has the same parameter values of the basic model, but which yields an equilibrium baseline projection with an equal number of vacancies and unemployed (100,000). In this situation the effect of a demand shock on employment is of about the same size as that of the supply shock; in both cases the additional employment amounts to somewhat less than 45% of size of the shock. Yet the effects of both types of shocks are not identical. The demand shock leads to an increase in the number of vacancies which surpasses (in absolute value) the decrease in unemployment induced by the shock. The supply shock yields the opposite effect: now the increase in unemployment is larger in absolute value than the decrease of the number of vacancies. Nevertheless this model simulation shows that a positive supply shock may enhance employment considerably when the numbers of unemployed and vacancies are in balance. Therefore it pictures a situation in which a stimulative supply policy can be useful from the perspective of augmenting employment. As the effects of negative supply and demand shocks are again almost the mirror images of the effects of the positive shocks, these simulation results are not presented in the table.

Table 5 summarizes the effects of (positive) labour supply shocks on employment according to all alternative versions of the model considered in the sensitivity analysis of this paper. The simulation results of the basic version of the model and of alternative 1 are already extensively discussed above. The results for alternative 2 indicate that in case of low labour market dynamics the effect of a temporary supply shock does, in the long run, not differ very much from that of the basic specification. This is somewhat against intuition because in case of low labour market dynamics weighted unemployment (U'), which is relevant for the production of matches in the matching function, is, due to the large number of long term unemployed, smaller than in the basic version of the model. Therefore, a positive shock to unemployment would have a larger impact in the case of low labour dynamics than in the basic version. Apparently this larger impact is offset by the reduced efficiency in the matching process, which is, as described above, a necessary assumption in order to keep the economy at the same point on the reduced form UV-curve in both versions of the model. The main difference in reaction to the shocks between both versions of the model is the recognition lag. This is much longer according to the version of the model with low labour market dynamics than according to the basic version of the model. The effects of a negative supply shock again appear to mirror those of a positive supply shock almost completely and are not presented in the table.

In alternative 3, with low labour market dynamics **and** a small escape probability for long-term unemployed, the short-run employment effects of a supply shock are indeed larger than with alternative 2, because U' is smaller so that the new labour supply has a larger weight in the production of matches. Yet, in the long run the effects become even smaller than with alternative 2. Moreover, it appears that the transition towards a new equilibrium takes rather a long time according to this alternative. The same is true for alternative 4 where unemployment has a large weight in the matching function. Now the effects of supply shocks on employment are much more substantial than in the previous alternatives with low labour market dynamics. Like in alternative 3 the effect increases during the first three years after the shock and decreases somewhat thereafter.

Figure 1 gives a graphical impression of the transition, induced by the shock, to the new equilibrium on the reduced form UV-curve of the model. The figure shows that the reactions to negative and positive shocks are almost symmetrical. Moreover, according to all charts of the figure the return to the new equilibrium value on the UV-curve follows a straight line after the initial 12 months' period of the shock. Yet the slope of this line appears to be different for the various versions of the model. The most remarkable transition to the new equilibrium - although not very well visible in the chart - occurs with alternative 3 (chart h). After the 12 months of the shock the economy first moves away from the new equilibrium and thereafter returns to it following the same line. It indicates that the transition dynamics can already become quite complicated in our simple model of labour market flows, when we take account of unemployment heterogeneity and of the flows through various duration classes.

Table 5. Effects of labour supply shocks on employment according to various versions of the flow models with duration dependence

(in % of the size of the shock which is implemented as an autonomous change of F_{uu})

	Model specification							
	Basic	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	Alt. 7
positive shock; effect after								
1 yr.	7.6	27.8	4.9	7.5	13.9	8.2	7.8	11.6
2 yrs.	8.9	40.6	8.1	10.2	22.4	8.9	9.3	8.9
3 yrs.	8.2	42.1	8.4	8.5	22.0	8.2	8.9	7.1
6 yrs.	8.1	42.4	8.6	7.0	21.4	8.1	8.6	5.4
10 yrs.	8.1	42.4	8.6	6.8	21.2	8.1	8.5	4.8

Table 5 also gives the results for alternatives 6 and 7 with smoothly decreasing escape probabilities from unemployment. According to alternative 6 the effect of the supply shock on employment has almost the same size as with the basic version of the model. This seems plausible as the average escape probabilities from unemployment are about the same in both versions of the model. Yet the transition towards the new equilibrium differs somewhat between these versions of the model. Alternative 7, with strong negative duration dependence, gives a different picture. Here the short term effect of the supply shock is rather large as compared to the other alternatives, but in the long run this effect diminishes considerably.

The present versions of the flow model assume that the matching function is the only transmission channel of a supply shock to demand. The model does not describe possible effects through wages and prices, which would lead to an induced demand shock. In other words, the model assumes fixed labour demand, or a vertical vacancy supply curve (in the Mortensen and Pissarides (1994) terminology)[5]. From that perspective our model may underestimate the employment effects of a supply shock.

[5] Endogenising vacancy supply and the wage formation process in the model in accordance with the unemployment equilibrium approach of Pissarides (1990) is part of our future research plan.

Figure 1.

In order to illustrate this we have run simulations with supply shocks and concurrent demand shocks of half the size of the supply shocks. Table 6 shows the results. Obviously the effects on unemployment are larger in this case than in the case that the supply shocks are not accompanied by demand shocks. Now, the table illustrates that the differences between the various versions of the model have become much smaller. The effect according to alternative 1, with an equal number of vacancies and unemployed, is again higher than according to the other versions of the model. Increasing returns to scale or low labour market dynamics do not matter very much in this case.

Table 6.Effects of labour supply shocks combined with demand shocks of half the size of the supply shocks, on employment according to the various versions of the flow models with duration dependence

(in % of the size of the supply shock)

	Model specification							
	Basic	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	Alt. 7
positive shocks; effect after								
1 yr.	35.2	44.1	18.8	21.7	20.5	38.2	35.4	39.4
2 yrs.	52.4	68.0	38.2	40.6	38.5	53.4	52.7	52.4
3 yrs.	54.0	71.9	46.5	46.9	45.0	54.1	54.4	53.3
6 yrs.	54.2	72.9	53.6	52.6	55.3	54.2	54.5	52.8
10 yrs.	54.2	72.9	54.4	53.4	59.7	54.2	54.5	52.5

5. CONCLUSIONS

The analysis of this paper is inspired by the high 'inactivity ratio' in some European countries and by policy proposals to enhance labour participation and employment by encouraging labour supply. The scope for these policy proposals is investigated using an empirical flow model of the labour market. The model, which has the matching function as main behaviourial equation, gives a consistent description of the flows between the stocks of unemployed, employed, vacancies and the non-participants on the labour market at the macro level. The parameters of the model are calibrated using recent actual data on labour market flows in The Netherlands and using parameter estimates from the literature for the matching function. The central projections of various versions of the model generate dynamic unemployment equilibria with constant escape probabilities from unemployment. In impulse analyses the propagation of shocks through various duration classes of unemployment is modelled explicitly, so that the model describes the dynamics of the escape probabilities from unemployment under the assumption of heterogeneous unemployment with (negative) duration dependence. Hence, the model allows for a positive employment effect of an autonomous positive labour supply shock, even when the wage formation process is left out of consideration.

The main purpose of the paper is to investigate the employment effects of these supply shocks (and of similar demand shocks) in numerical calculations which mimic a real world situation and to see in a sensitivity analysis how the size of these effects depends upon the pace of structural change, the degree of duration dependence, the distribution of the escape probabilities from unemployment and the specification of the matching function.

A major conclusion is that a positive labour supply shock enhances employment indeed, but that, according to the basic version of the model, employment effects of an autonomous increase of labour supply appear to be so modest that a stimulative labour supply policy in order to augment employment can be regarded as ineffective and should be accompanied by a labour demand policy. The simulation experiments show that, given the present number of vacancies an unemployed in The Netherlands, such additional demand policy is essential, even when we allow for the fact that the escape probability for the long-term unemployed is much smaller than for the new labour supply. The sensitivity analysis of this paper illustrates that the above conclusion is also true in the case of low labour dynamics where the share of long term unemployed is, as yet, much larger than in the actual situation. Only in a (unrealistic) combination of low labour market dynamics, high duration dependence and a high weight of unemployed in the matching function we find long run employment effects of a supply shock which are substantially higher than according to the basic version of the model. Yet, the simulation experiments reveal that the transmission dynamics of a supply shock (and also of a demand shock) depend much on the pace of labour market dynamics and on the degree of duration dependence. Here the modelling of the propagation of the shocks through the various duration classes of unemployment appears essential. Moreover, our experiments highlight the importance of a consistent modelling of labour market dynamics at the macro level: calculation of the impulse effects by using a matching function only - as micro studies of the labour market often do - can be very misleading. The structural model of the paper shows that dynamics of responses to shocks can be much different, even in situations where the unemployment and vacancy equilibria are located on the same point of the (reduced form) UV-curve. These differences depend upon the degree of duration dependence, the pace of structural change and the (structural) specification of the matching process. This sheds new light on the use of UV-analysis for the evaluation of developments on the labour market[6].

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[6] See e.g. Muysken (1989) for a survey of the use of 'traditional' UV-analysis in The Netherlands.

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Annex. List of symbols

Flows of persons

EI	(420)	Inflow into employment
EI_{ex}	(220)	Autonomous inflow into employment (other than unemployed filling a vacancy)
EO	(420)	Outflow from employment
F_{uev}	(200)	Unemployed who find a new job by filling a vacancy
F_{nu}	(120)	Non-participants who register as unemployed (additional labour supply)
UI	(420)	Inflow into unemployment
UI_{ex}	(300)	Inflow into unemployment from employment (= F_{eu})
UO	(420)	Outflow out of unemployment
UO_{ex}	(220)	Autonomous outflow out of unemployment

Flows of jobs

VI	(600)	New vacancies (additional labour demand)
VO	(600)	Outflow of vacancies
VO_{ex}	(400)	Autonomous outflow of vacancies
VO_u	(200)	Vacancies filled by unemployed

Stocks

E	Employment
U	Unemployment
U_S	Short term unemployment (< 1 year)
U_L	Long term unemployment (> 1 year)
V	Vacancies

Other symbols

$\pi_{1,t}$	Escape probability of unemployed from the first duration class
$\pi_{k,t}$	Escape probability of unemployed from the k-th duration class
π_S	Escape probability of short term unemployed
π_L	Escape probability of long term unemployed
$U_{k,t}$	Number of unemployed in the k-th duration class
θ	Duration dependence parameter

Explanatory note:values in parentheses represent the annual size of the flows used in the basic projection (in 1000 persons)

Summary

LABOUR PARTICIPATION AND LABOUR MARKET DYNAMICS IN AN EMPIRICAL FLOW MODEL WITH HETEROGENEOUS UNEMPLOYMENT

A flow model of the Dutch labour market is used to calculate the effects of autonomous labour demand and supply shocks on employment and unemployment. The model is centered around a matching function which allows for heterogeneous unemployment by taking explicitly account of flows through various duration classes of unemployment. The model describes the interaction between flows of jobs and flows of persons, and is based on times series data with respect to these flows at the macro level. A positive labour supply shock, representing a policy which aims at enhancing labour participation, appears to lead to more employment indeed, but the effect is rather small in case of the present situation in The Netherlands with much more unemployment than vacancies. A sensitivity analysis shows to what extent the effects of labour supply and demand shocks depend upon the pace of labour market dynamics and on the relative position of the reduced form UV-curve implied by the model.

key words:
matching of unemployed and vacancies, labour supply shocks, duration dependence, structural change, simulation model, impulse response effects

JEL codes: J23, J64.